PALEONTOLOGY.—*The Occurrence of* Lituonella *and* Coskinolina *in America.* JOSEPH A. CUSHMAN, Sharon, Massachusetts.[1]

In an earlier volume of this Journal, Woodring[2] noted the occurrence of the conical foraminifer *Dictyoconus* in Haiti and later described two new species and a new variety. These occur in the Middle Eocene, as does the genus in the Mediterranean region. Some years ago, in studying well-samples from Florida, I found both conical and more flattened foraminifera which seemed to belong to the Cretaceous genus *Orbitolina* and to certain other arenaceous "Buliminas" similar to species characteristic of the Lower Cretaceous. Since that time a more careful study of species of *Orbitolina* and of sections of the Florida specimens has convinced me that the determination of the latter as *Orbitolina* was incorrect and that the beds containing them are of Middle Eocene age. A year or more ago, in studying the essential characters of *Lituonella* and *Coskinolina*, I came to the conclusion that specimens from the Florida wells could be referred to both these genera. In addition the "Buliminas" are now known to belong either to *Valvulina* or to a newly erected genus *Arenobulimina*,[3] which have affinities with Cretaceous species and, superficially at least, resemble them in many ways. Silvestri has erected a new genus *Cushmania* based on my *Conulites americana* from the Eocene of the Leeward Islands. This genus also appears to occur in the Florida well-samples. The relationships of these different genera are very interesting, as the following paragraphs indicate.

Valvulina is triserial with a large aperture and a flattened tooth. The species in the material under discussion, which occurs below the Ocala limestone, is in the young flattened on the three sides and appears to be an ancestral form of *Valvulina ocalana* Cushman.

In *Arenobulimina* the early stages are triserial; in the adult several more elongate chambers make up each whorl and the test broadens. Species of this genus also occur in the well-samples.

Lituonella has the early stages like those in *Arenobulimina* but by acceleration these are passed through quickly in the development of the test. In the adult the chambers become discoid and the test is made up of a series of these disc-like chambers gradually increasing in size as each is added. The aperture is multiple, on the basal face. The later discoid chambers are labyrinthic but there seems to be no

[1] Received February 15, 1927.

[2] This JOURNAL 12: 244–247. 1922.

[3] CUSHMAN, Contr. Cushman Lab. Foram. Research 2(4): 80. 1927.

distinct division into a cortical and an interior set of chambers. At the apex of each specimen there is a miniature *Arenobulimina*. Specimens such as are figured by Schubert[4] occur in several of the Florida wells and do not seem to differ specifically from *Lituonella liburnica* (Stache), described from the Middle Eocene of the Istrian-Dalmatian coast.

Specimens in the well-samples also seem to be identical with *Coskinolina liburnica* Schubert, from the Middle Eocene of the Istrian-Dalmatian coast. The early eccentric young stages are very well preserved in some of the specimens, and the general form and size is so close to Schubert's species that there seems nothing to separate them. Sections show the same simple irregular arrangement of the interior chamberlets and, although the exterior when worn shows the radial division of the subsurface of the discoid chambers, there are no such definite divisions as occur in *Dictyoconus* or *Chapmania* and the walls are simple.

Occurring with *Coskinolina* is a large species as much as 3 millimeters in diameter, with the apex a sharp cone, the sides thence concave, and flaring at the base with the basal face convex. The peripheral portions of the chambers end in fine tubuli. The species is apparently the same as that from the Leeward Islands described by me as *Conulites americana* but to which Silvestri has given the generic name *Cushmania* and which should be known as *Cushmania americana* (Cushman). The early stages appear to have the chambers arranged as in *Coskinolina* and it is probable that it came from that genus, in which case the developmental series would be: *Valvulina—Arenobulimina—Cribrobulimina—Lituonella—Coskinolina—Cushmania.*

In some of the wells at somewhat lower levels a species occurs which is much flattened and has a concave base. I take it to be *Dictyoconus codon* Woodring, already described from the Middle Eocene of Haiti. In this species the outer chambers are divided so that there are two layers of chamberlets in each chamber, a structural feature much more like that of *Orbitolina* than of the other genera already considered.

Altogether this makes four genera of the conical foraminifera represented in these Middle Eocene strata of Florida, two of which, *Lituonella* and *Coskinolina*, have previously been unknown in the Western hemisphere.

[4] Jahrb. geol. Reichsanstalt **62**: *pl. 10, f. 10, 11.* 1912.